Posted: Tue Jul 11, 1989 11:32 AM EDT Msg:
AJIJ-1608-4986
From: PARDANUY
To: DHAN
CC: MODIS.DATA.TEAM
Subj: MODIS Meeting Minutes

TO: Distribution July 10, 1989

FROM: Daesoo Han

SUBJECT: MODIS Data Study Team Minutes for June 9

ATTENDEES:

Mike Andrews	GSC	953-2700
Phil Ardanuy	RDS	982-3714
Dave Case	ARC	805-0305
Hyo-Duck Chang	STX	794-5000
Jim Czechanski	II	794-9016
Dave Folta	GSC	953-2700
Daesoo Han	636	286-9414
Doug Hoyt	RDS	982-3732
Lee Kyle	636	286-9415
Al McKay	RDS	982-3720
Jim Ormsby	624	286-6811
Lanning Penn	RDS	982-3726
Vince Salomonson	600	286-6481
Tom Wolford	GSC	953-2700

NEXT MEETING: The next meeting of the MODIS Data Study Team will be held at 9:00 AM, Friday, June 16, in Building 28, Room W125.

TOPICS:

1. The status of the MODIS Data Study was reviewed. The Preliminary Team Member Science Product Summary (deliverable due at the end of May) was delivered for review and efforts are proceeding on schedule. The next scheduled deliverables are the Input Data Attributes Report and the MODIS Data Product Algorithm Report, due at the ends of June and July, respectively.

2. A set of data flow diagrams defining first and second tier MODIS Level-1 processing was presented. The diagrams show those aspects of Level-1 processing that are unique to MODIS data, but do not include aspects that are common to all EosDIS processing,

such as processing control, interfaces to common databases, etc.
These aspects of the data flow will be defined by the EosDIS team.

At the highest level, MODIS-unique Level-1 processing consists of four functions: 1.0 Receive Data, 2.0 Compute Observation Geometry, 3.0 Generate Calibrated Radiances, and 4.0 Format Output Products. The Receive Data function breaks down into 1.1 Ingest Data, 1.2 Check/Correct Data Transmission, 1.3 Rectify Time and Engineering Data, 1.4 Verify Instrument Operation, 1.5 Verify Platform Ancillary Data, and 1.6 Reformat and Match Data and Append Headers. The Compute Observation Geometry function consists of 2.1 Select Anchor Points, 2.2 Compute Geometry for Anchor Points, 2.3 Apply DQA Criteria, and 2.4 Compute Metadata. The possible use of automated processing of ground control points to provide improved earth location will be included in initial MODIS data considerations. Required corrections may be applied using a Kalman filter or perhaps a retrospective filter that makes use of control point information obtained after an observation to obtain the best earth-location estimate for the observation.

The Generate Calibrated Radiances function consists of 3.1 Estimate Current Calibration Coefficients, 3.2 Apply Calibration Coefficients, 3.3 Apply DQA Criteria, and 3.4 Generate Radiance Metadata. As with earth-location estimates, a Kalman filter or other estimation technique may be appropriate to obtain best estimates of calibration coefficients.
The Format Output Products function just assembles the output product: 4.1 Set-Up Template Controls, 4.2 Fill-In Templates, and 4.3 Output Products.

3. As a part of the effort to define Level-1 processing interfaces, the interface between the DHC and the CDHF for Level-0 and Ancillary Data was discussed. The nature of data to be transmitted across the interface, the volume of data to be transmitted, the format of the transmitted data, the physical

medium to be used to provide the link, data transmission schedules and time constraints, and the storage of data were discussed.

4. For information, material describing an optical system under development to measure the structural flex of an orbiting platform was reproduced from the June 5 issue of Aviation Week and Space Technology and included in the weekly handout.

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	V. Salomonson	(VSALOMONSON)
	B. Sharts	(BSHARTS)
	M. Somerville	(MSOMERVILLE)
	L. Stuart	(LSTUART)
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NEXT MEETING: The next meeting of the MODIS Data Study Team will be held at 9:00 AM, Friday, June 23, in Building 28, Room W125.

TOPICS:

1. The effect that atmospheric refraction will have on earth position determinations for MODIS was analyzed and results were summarized in a report to the MODIS Data Team. For a slant path at 55 degrees from nadir, apparent positions of features can differ from straight-line, geometrically determined positions by as much as 0.025 degrees. Although this correction seems small, an object viewed at this angle will appear to be about 4 kilometers further from nadir than it would if no atmosphere existed.

The report included an overview of results obtained by original investigators of atmosphecic effects and a discussion of parameters that determine the magnitude of the apparent shifts. Results depend on atmospheric temperature. An approximation that relates diffraction to surface atmospheric temperature shows that a variation in surface temperature from -10 to +30 degrees Celsius causes a change in apparent position of as much as

0.7 km. at a 55 degree nadir angle. If climatological tables are used to determine surface temperatures, required position-location accuracy would be attained about 95% of the time. A plot showing the effect of atmospheric temperature on apparent position was included.

Effects also depend on atmospheric pressure. Day-to-day variations in atmospheric pressure will only rarely cause variations in apparent position exceeding 80 meters, so variations in atmospheric pressure can probably be ignored. However, atmospheric pressure variations caused by changes in the altitude of observed objects are not negligible, and model inputs from a Digital Elevation Model (DEM) will probably be required for the atmospheric correction computations.

2. Five sample plots of digital elevation data obtained from the National Geophysical Data Center (NGDC) were presented. Although 5-minute resolution is claimed for the data, the step-like appearance of some of the data suggests that full accuracy has not been attained for all data sets.

3. A proposed outline for the MODIS Input Data Attributes Document was presented for review and comment.

4. The projected role of the CDOS in checking MODIS and other instrument data and verifying platform position and velocity parameters was discussed. Instrument data verification will make use of error correcting codes. If GPS data is available, the Flight Dynamics Facility (FDF) will provide only orbit verification data that will be used for limit checks of GPS generated data (sanity checks). If discrepancies are found, the FDF will play a more active role in determining correct orbital parameters.

5. An implementation status report for GPS was presented. The second operational GPS satellite was launched last week. Twenty-one to twenty-four satellites will ultimately be launched. GPS

general service will provide an accuracy of about 100 meters in each of three dimensions. The GPS precise service will provide an accuracy of about 10 meters in each dimension. Research efforts are underway to apply GPS for platform attitude determination; substantial improvements in attitude determination for orbiting platforms may be possible.

6. A reprint of an article discussing ocean color and data obtained by the Coastal Zone Color Scanner (CZCS) was distributed for easy MODIS Data Team reference.

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NEXT MEETING: The usual Friday meeting of the MODIS Data Team will not be held on June 30 or July 7. The next regular meeting of the MODIS Data Study Team will be held at 9:00 AM, Friday, July 14, in Building 28, Room W205E.

TOPICS:

1. On Wednesday, June 21, Dr. Skip Reber/Code 610, Project Scientist for the Upper Atmosphere Research Satellite (UARS), presented a discussion of the UARS data system to the MODIS data team. A report on his discussion was included in the regular Friday presentation to the MODIS Data Team. Since many of the data system issues addressed in the UARS project are similar to those affecting MODIS, the following notes are included for reference:

a. Telemetry and Level-0 Data

The UARS instrument complement and satellite ancillary data will yield a joint data rate of about 32 kilobits per second (kbps). The data will be stored on two tape recorders and dumped to the TDRSS once per orbit. The GSFC Data Capture Facility (Code 500) will perform the Level-0 processing. A separate Level-0 product will be issued for each of the ten instruments on the UARS.

b. Processing Priorities

Three different processing priorities will be available. In routine processing, 24-hour chunks of data will be made available for Level-0 processing within 12 hours of the last data. In the near-real-time processing, one orbit of data (a single tape recorder dump) will be made available for Level-0 processing immediately for every eight hours (12% of the data). In the real-time processing, 15 minutes of the UARS data stream will be made available once per orbit for every TDRSS contact (17% of the data). Experimenter-driven scheduling of the TDRSS contacts is not anticipated, except during the activation period immediately after launch.

c. UARS vs. Eos

We can compare UARS to Eos/NPOP-1, as in each case the platform will carry a wide variety of instruments, each with its own PI and instrument team. Each instrument will have its own separate Level-0/1/2/3 processing The format of the Level-1 and Level-2 products will be defined individually for each instrument/investigator. The format of the Level-3 products will be common for all the instruments. The ultimate Level-3 product (3B) will be at a relatively low spatial resolution (every four degrees of latitude), in the form of Fourier coefficients, defined at 40 pressure levels, and will be daily data. A further time averaging (diurnal/monthly, etc.) will be non-standard and defined by the individual user. Standard formatted data units are being used for Level-2 and Level-3 products, and are being developed with the assistance of Don Sawyer of NSSDC.

d. UARS vs. MODIS

We can also compare UARS to MODIS, for a number of reasons. The MODIS science team (24 persons) is larger than that of UARS (19 to 20); however, UARS will have on the order of 120 PI's and co-I's. The MODIS data rate will be about 300 times higher than that of UARS. The MODIS data, coming from the two instruments, will serve the atmospheric, oceanic, and terrestrial science communities. Many MODIS data products have been identified for generation and distribution.

e. Data Processing and Distribution Strategies

Unlike MODIS and Eos, UARS will have a two to three year exclusive-use period for the science team to examine the data before distribution. The UARS goal is to validate the instruments and algorithms within six months after launch. After validation, a steady-state processing lag through all levels of one to two weeks is anticipated. The delay is caused by a combination of Level-0 processing delays, generation of the definitive ephemeris (non-GPS), and the need of some instruments to process large blocks (e.g., one week) of data at a time.

f. Standards, Commonality, and Data Distribution

UARS requires coding in FORTRAN 77. Each PI has been provided with a Remote Analysis Computer (RAC). The common architecture is VAX/MicroVAX. The CDHF has a VAX 8800 and 6310, and is partitioned into user space and processing space. This distinction is made so that data processing will not be slowed even during periods of peak user demand. All PI's are connected to the CDHF through dedicated 9.6 kbps lines; an upgrade to 56 kbps lines will be complete by the end of the year.

g. Simulated Data and Algorithm Development

Simulated data has been used to develop algorithms. An initial distribution of one day of simulated data was made. A new simulated data set incorporates three days of measurements. Version 1 of the data processing software has already been developed and delivered to the CDHF, where it is presently running on the simulated data. Flight ready software delivery is anticipated by January 1990. It is anticipated that the code will be in place and operating nine months before launch.

h. Estimating Processing Requirements

Users have been continually asked to estimate their data processing requirements. It has been estimated that the algorithms for all the instruments will require 700 to 800 MIP-hours to process one day's data. A factor of three (2 * 1.5) is used to account for processing (100%), reprocessing (100%), and contingencies (50%). (On the order of a 100 MIP processing capacity is required.) Individual PI processing estimates have gone up by a factor of four (in six months) to 30 (in a few years).

i. Peer Reviews and Configuration Control

Constructive peer reviews of algorithm processing activities are held to review the original algorithms and after every change in processing requirements. The project scientist chairs a configuration review board to review proposed algorithm changes.

j. Reprocessing

All data that is reprocessed will also be retained in its original form.

2. Several members of the MODIS Data Team interviewed Gene Smith on June 19 to obtain the latest information on services to be provided by the CDOS. It appears that many specifics of the system are still being defined and that additional information will probably not be available until the CDOS Phase B contractors complete the competitive phase of their operations at the end of May, 1990.

CDOS support to the MODIS instrument will depend on whether MODIS is declared to be a high-rate instrument with its own dedicated virtual data channels and direct on-board cableway access, or whether MODIS is treated as one of several low-rate instruments that will share common data transfer frames and a common data network on the platform. A hybrid structure that would treat MODIS-Science-Data as high rate information and MODIS-Engineering-Data as low rate information is also possible.

3. A draft outline for the MODIS Data Team presentation to the MODIS Science Team during the summer meeting on July 5,6, and 7 was presented for review and comment. Several changes in structure were suggested to provide particular emphasis to items that are of special concern to the Science Team.

4. Interactions between the MODIS Data Study Team and other organizational entities concerned with data system requirements and design were charted in general flow diagrams and examined in-depth for key events between the affected organizations, the flow direction for requirements and design specifications, and impact on the MODIS data effort. Six organizations that have direct interaction with the MODIS data team were identified; most of these entities, in turn, have interaction with one or more supporting contractors, so that altogether, fifteen organizations (besides the 24 Science Team Members) providing input to or receiving input from the MODIS Data System were identified. Interactions were examined in terms of the flow of requirements between organizations, the flow of design specifications generated in response to requirements, and the time schedule for these events.